Canon

EOS DIGITAL REBEL XT

WHITE PAPER

THE CANON EOS DIGITAL REBEL XT CAMERA:

AN EXCEPTIONAL COMBINATION OF DESIGN, PERFORMANCE AND AFFORDABILITY

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I. OVERVIEW

Canon's EOS® Digital Rebel XT camera combines outstanding performance and creative control in a small and elegant package for an estimated retail price of under $1,000* complete with zoom lens. This makes the XT an exceptional value in digital single lens reflex cameras. With its DIGIC® II image processor and Canon-designed and manufactured CMOS sensor, the EOS Digital Rebel XT camera has very high 8.0 megapixel resolution, low noise, exquisite color, near-instantaneous startup, speedy handling, enhanced flash control, an extensive range of settings, full compatibility with EOS system accessories, reduced power consumption and an ease of use which makes it truly remarkable.

The Digital Rebel XT camera's closest relatives in the Canon DSLR lineup are the original EOS Digital Rebel and the EOS 20D models. The original Digital Rebel is the breakthrough camera that established the under $1,000 category for DSLR (Digital Single Lens Reflex) cameras when it was introduced in 2003. It has 6.3 megapixel resolution, wonderful picture quality and true ease of use. The Digital Rebel remains in the Canon lineup at a new, lower price point (estimated retail price $799* with EF-S 18-55mm zoom lens). The EOS 20D body has an estimated retail price of $1599* (with the EF-S 18-55mm lens) and is faster than the Digital Rebel XT (5 frames per second vs. 3), shoots longer bursts (23 Large/Fine JPEGs vs. 14), focuses faster, has more extensive Custom Functions (18 vs. 9) and magnesium alloy body covers (vs. polycarbonate for the Digital Rebel XT). The 20D has 8.2 megapixels to the 8.0 of the XT; the sensors have the same size pixels. The 20D's aficionados include advanced amateurs, prosumers and professionals who need to keep an eye on equipment expenses. Of course, all these cameras have full compatibility with the vast system of Canon EF and EF-S lenses, as well as many other EOS system accessories. (* Actual selling prices are set by the dealer and may vary.)

The EOS Digital Rebel, EOS Digital Rebel XT and EOS 20D are members of a family that also includes the 8.2 megapixel, 8.5 frames per second EOS-1D Mark II and the 16.7 megapixel EOS-1Ds Mark II. These cameras, and an extensive line of consumer-focused digital point-andshoots, have propelled Canon to the number one position in the digital camera business according to the NPD Group, a leading provider of retail market information. In 2004, Canon had 20.4 percent of total digital camera sales, based on

Digital Rebel | **Digital Rebel XT** | 20D | 1D Mark II | 1Ds Mark II

unit sales and revenue figures of both compact cameras and digital SLR cameras combined, according to NPD. In addition, Canon had 62.8 percent of the DSLR market and 18.6 percent of the point-and-shoot market, also both number one according to NPD. Further, according to NPD, Canon had the single best selling digital camera, the PowerShot A75, as well as the best selling digital SLR, the EOS Digital Rebel.

This sell-through data is testimony to the extent to which consumers and professionals alike recognize Canon as the imaging industry leader. For example, the readers of PC Magazine recently gave Canon's digital cameras their highest rankings in quality, reliability and support in an annual customer satisfaction survey. In 2004, Canon digital cameras were also honored by Macworld, C/NET, American Photo, PC World, Mobile PC Magazine, Best Magazine, Popular Science, Outside Magazine and PTN Magazine, among others. Canon is listed as one of Fortune's Most Admired Companies in America and is number 35 on Business Week's 2004 list of "Top 100 Brands."

Only Canon Could Produce the EOS Digital Rebel XT

In 2004, IBM received the most U.S. patents, as it had in each of the previous ten years.[1] Canon was third. In the past ten years, Canon has been second on six occasions and third on four. Considering the differentials in size, sales volume and R&D investment levels between Canon[2] and IBM[3], Canon's performance in this category is nothing short of phenomenal.

[1] Source: United States Patent and Trademark Office (USPTO) ‹http://www.uspto.gov/›
[2] Source: Canon Inc. 2003 Annual Report ‹http://www.canon.com/ir/annual/2003/index.html›
[3] Source: IBM 2003 Annual Report ‹http://www.ibm.com/annualreport/2003/index.shtml›

Top 3 Organizations Receiving U.S. Patents: 1995-2004

Rank	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
1	IBM	IBM	IBM	IBM	IBM	IBM	IBM	IBM	IBM	IBM
2	Matsushita	**Canon**	**Canon**	NEC	NEC	NEC	**Canon**	**Canon**	**Canon**	**Canon**
3	**Canon**	HItachi	Micron	**Canon**	**Canon**	**Canon**	NEC	NEC	Motorola	U.S. Govt.

2003 Gross Reveue and R&D Investment

Organization	Net Sales	R&D Investment
Canon Inc.	$29.9 Billion	$2.42 Billion
IBM	$89.1 Billion	$5.08 Billion

Canon concentrates its research on what it calls "core technologies." Currently, these include nanotechnology, ultra-fine particle technology, organic electroluminescent displays and thin-film displays. The company is in the forefront of computer-aided 3D-CAD product design and software development and is one of the leading manufacturers of semiconductor production equipment ("steppers," etc.). Canon makes its own mold production equipment, as well as the tuning and measuring tools required for the development, maintenance and repair of the machinery it designs and manufactures.

Canon's patents are a measure of intellectual wealth and corporate ethos. Discoveries in the core technologies are applied to products for industry, healthcare, broadcasting, business and consumers. Because Canon continues to innovate at a furious pace, each new product incorporates significant advances in electronics, mechanics, optics and software.

Any new product from Canon, but especially a new digital single lens reflex camera, is the fruit of this intellectual wealth. For instance, virtually every significant piece of hardware in the new EOS Digital Rebel XT is designed and made by Canon on machinery that is also designed, made and maintained by Canon.

As early as the mid-1980s, Canon made the risky and challenging decision that it would, eventually, design and manufacture its own image sensor chips for digital SLRs rather than purchase off-the-shelf image sensors from an external supplier. Canon's extraordinary success in this venture has freed it from the syndrome of me-too products with the same internals as everyone else's. Similar achievements were made in the design, development and manufacturing of Canon EF lenses and DIGIC® image processors, which together with Canon CMOS image sensors comprise the three main components of every Canon EOS digital camera. As it pushes the limits of technology, Canon can optimize the design, performance and cost of every key component in every new digital single lens reflex camera it makes.

Canon EOS DSLRs are unique in the photography industry in terms of their design and manufacturing and, therefore, their performance and value. This is the heritage of the EOS Digital Rebel XT camera.

EOS Digital Rebel XT Advantages

The EOS Digital Rebel XT camera has 8 million effective pixels on its sensor. Several competitive models have about 6 million pixels. How much do those extra pixels matter? Also, there are compact consumer or "prosumer" cameras that cost between $700 and $1000 and also have 8 million pixels. How do they compare?

It is generally understood that if one has more pixels, one can make bigger prints. Having more pixels also means that one can crop a bit from one's original image and still have lots of pixels left for printing. Pixel quantity also matters because several components of image quality are resolution dependent. Aliasing, or "jaggies," gives a rough-edged appearance to lines that cut diagonally across the rectilinear grid of square pixels. More pixels reduce the effects of aliasing and improve image quality. Based on these factors, the EOS Digital Rebel XT has a clear advantage compared to any digital SLR with lower resolution.

8-megapixel compact digital cameras use image sensors that are much smaller than the unit in the EOS Digital Rebel XT camera. Most are 8.8 mm by 6.6 mm, compared to the 22.2 mm by 14.8 mm sensor in the XT. Each pixel is therefore much, much smaller in

the compact, all-in-one 8 megapixel cameras. These tiny pixels necessarily receive less light during exposure. Their meager output signal needs to be amplified heavily in order to get useful information for image processing. That amplification gets applied not just to the image file, but also to any other non-image signal on the sensor, such as heat. The digital noise that results, particularly at high ISO speed settings, is unmistakable.

Image sensor size comparison: 8.0 megapixel Digital Rebel XT (Red) vs. 8.0 megapixel compact digital camera (Black)

Compact digital cameras are also typically equipped with noninterchangeable lenses, surely a limitation. Their pre-set controls are mostly menu-driven and not suited to in-the-moment operation; most if not all are also slow to start up and slow to take a picture when the shutter button is pressed. Predictive autofocus with fast-moving subjects is invariably out of the question. For a similar cost, the EOS Digital Rebel XT camera offers compatibility with the entire range of Canon EF and EF-S lenses, Canon EX-series Speedlites and most EOS system accessories, plus speed, responsiveness and a complete set of controls to make the camera function superbly in any shooting situation. And if in the past size and weight were problems with digital single lens reflex cameras, the XT is a must-see.

How does the EOS Digital Rebel XT camera compare with its DSLR brethren? Its advantages are overwhelming. The XT has the highest image quality in its class. It is the smallest and lightest EOS Digital SLR ever made, as of February, 2005. In fact, the least expensive camera that equals its performance is its brother, the Canon EOS 20D, costing approximately $600 more. Nothing else comes close. The XT has a complete range of functions and controls. It is remarkably fast and easy to use and its ultracompact body is a delight. The EOS Digital Rebel XT is the DSLR for everyone.

II. SUMMARY OF NEW AND IMPROVED FEATURES

Design

- Smallest Canon EOS Digital SLR ever: 25% smaller in total volume and 2.5 ounces lighter than the original EOS Digital Rebel/300D Digital
- Among the smallest and lightest cameras in its class
- Exterior color choice of black or silver
- As with the EOS 20D camera, Canon logo embossed and colored Image

Image Recording

- Entirely new 8.0 million pixel CMOS sensor designed and made by Canon with improved microlenses and 2nd-generation on-chip noise reduction technology
- New DIGIC® II image processor provides enormous speed gains, improved color reproduction, precisely optimized white balance and expanded dynamic range
- Maximum shooting speed: 3 frames per second with a burst rate up to 14 frames in Large/Fine JPEG, 5 frames in RAW or 4 frames in RAW + Large/Fine JPEG
- New, high-performance, 3-layer optical low-pass filter, the same quality used in top-of-the-range Canon DSLRs, provides high resolution while minimizing false colors
- Startup time now approximately 0.2 seconds
- Shutter release time lag reduced from about 120 milliseconds to 100 milliseconds (compared to Digital Rebel)
- Viewfinder blackout time reduced from about 225 milliseconds to 170 milliseconds (compared to Digital Rebel)
- CF card data-writing speed approximately 3.5 times faster than Digital Rebel
- New RAW + JPEG setting with separate Large/Fine quality JPEG files written, rather than embedded, and saved as separate files on the CF card
- No dedicated application needed to extract JPEG data

Image Processing

- Improved auto white balance performance, especially at higher ISO ratings and in conjunction with flash color data transmission from the built-in flash or the accessory 580EX Speedlite

- New white balance correction, same as on EOS 20D, allows fine tuning in Blue-Amber and/or Magenta-Green color ranges, +/- 9 levels
- New white balance bracketing in Blue-Amber or Magenta-Green direction, +/- 3 steps
- White balance bracketing can be used in combination with white balance correction
- Six image processing Parameter Sets provide complete control of sharpness, contrast, saturation, and color tone
- New monochrome Parameter Set allows Standard B&W, B&W with filter effects or B&W with toning effects
- Custom Function 2 provides optional dark frame subtraction noise reduction at shutter speeds longer than 1 second Enhanced

Enhanced User Controls

- Selectable AF modes: One-Shot, AI Servo or AI Focus
- Selectable metering patterns: 35-zone Evaluative, Centerweighted Average, and Partial (approx. 9% of viewfinder)
- Adjustable Flash Exposure Compensation up to +/- 2 stops
- Nine Custom Functions with 24 settings including mirror lock
- Three JPEG resolution options: Large, 8 megapixels; Medium, 4.1 megapixels; Small, 2 megapixels
- Cross keys can now be used to select the AF point directly via Custom Function 1-4
- New Quick Menu function gives direct access to frequently used settings via cross keys
- Shutter speeds now user-settable in 1/3 or 1/2 stop increments
- Exposure compensation now possible in any auto exposure mode, up to +/- 2 stops, in 1/3 or 1/2 stop increments
- Fifteen menu interface languages
- Playback options accessed with the Info button include single image with or without basic info overlay, or with full shooting information
- Jump display now offers a choice of 10 or 100 images forward or back in single play mode, or jump by the shooting date
- New, brighter, “Precision Matte” focusing screen for greater contrast and “snap” with manual focusing

Flash Performance

- E-TTL II improves accuracy and consistency of flash exposure
- E-TTL II is available with built-in flash and all EX-series Speedlites
- E-TTL II works with all Canon EF and EF-S lenses
- Distance information from compatible Canon EF lenses now used in flash exposure calculation
- Evaluative E-TTL II flash metering no longer linked to active AF point
- Average E-TTL II flash metering from all 35 zones now possible via Custom Function 8-1
- Digital Rebel XT has built-in adjustment for flash exposure compensation, up to +/- 2 stops in 1/3 or 1/2 stop increments, and flash exposure bracketing with compatible Canon Speedlites
- Digital Rebel XT supports new functions of accessory 580EX Speedlite, including auto zoom adjustment for sensor size and color temperature data transmission

- Built-in flash is 5.5 mm higher than EOS Digital Rebel camera, reducing red-eye and vignetting, and covers 17mm focal length
- Modeling flash for preview purposes, a 1 second continuous burst at 70 Hz, possible with compatible Canon flash units
- New second-curtain flash sync with Canon EX-series Speedlites and Custom Function 9-1
- Wireless E-TTL II provides ratio control of up to three flash groups over a six stop range with select Canon EX-series Speedlites and ratio control of up to two flash groups with accessory Speedlite Transmitter ST-E2

Connectivity and Compatibility

- New USB 2.0 Hi-Speed interface, ten times faster than original Digital Rebel
- New recording format DCF 2.0 with Exif 2.21 supports Adobe RGB color space
- One-touch direct print capability with PictBridge support, via new Direct Print button
- Faster direct printing speeds than with EOS Digital Rebel camera.

Power Issues

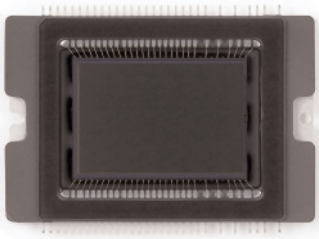
- EOS Digital Rebel XT camera uses one NB-2LH rechargeable Lithium-Ion battery, smaller and lighter than BP-511 of EOS Digital Rebel camera
- EOS Digital Rebel XT consumes 35% less power than original Digital Rebel, primarily because of DIGIC II
- XT battery life with NB-2LH battery pack is the same as the Digital Rebel with BP-511 battery pack (600 shots w/o flash; 400 shots w/50% flash)
- New accessory BG-E3 battery grip works with either six AA batteries, or up to two NB-2LH batteries which double shooting capacity
- Accessory AC Adapter Kit ACK700 enables camera to be powered by an AC outlet

Software Package

- New software package includes Canon's Digital Photo Professional Version 1.6 plus EOS Digital Solutions Disk Version 10, featuring ZoomBrowser EX 5.1, ImageBrowser 5.1, CameraWindow 5.1, PhotoRecord 2.2, RAW Image Task 2.0, EOS Capture 1.3, PhotoStitch 3.1, TWAIN and WIA drivers, ArcSoft PhotoStudio 5.5, and a separate CD containing instruction manuals for all included software

III. FEATURE DISCUSSION

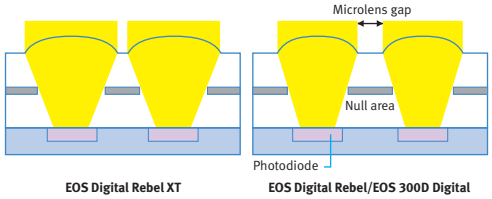
New 8 Megapixel Image Sensor



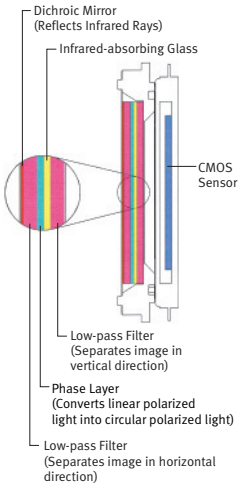
CMOS Sensor

The component of the new Canon EOS Digital Rebel XT camera that will receive the most first-look attention is the all-new, Canon-designed and manufactured, 8.0 effective megapixel, single-plate, CMOS sensor. It has a 2:3 aspect ratio (the same as 35mm film), with 2312 x 3472 effective pixels. The imaging surface is 22.2 mm by 14.8 mm, giving a focal length conversion factor of 1.6x. Each pixel is a generous 6.4 µm square.

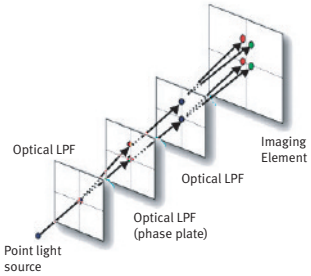
Several engineering features account for the sensor's wide ISO range (100 to 1600), low noise, high dynamic range, and low power consumption. The configuration of each photo diode in each pixel has been optimized; detail processing has been improved, and a greater portion of each pixel is now sensitive to light. The microlens array which gathers light for the sensor has a new design, shared with the microlenses in the EOS-1Ds Mark II, 1D Mark II and 20D that reduces the gaps between the lenses. This narrow-gap array gathers light more efficiently and loses less light between the lenses.



The new, 3-layer optical low-pass filter has the same construction as the EOS 20D's filter, an infrared absorbing glass and three crystal plates having different optical axes. A dichroic mirror with a dielectric, multi-layer coating on the front surface deflects light over a wide range of infrared wavelengths. There is also an infrared-absorbing glass layer to absorb nearinfrared wavelengths in the visible spectrum.

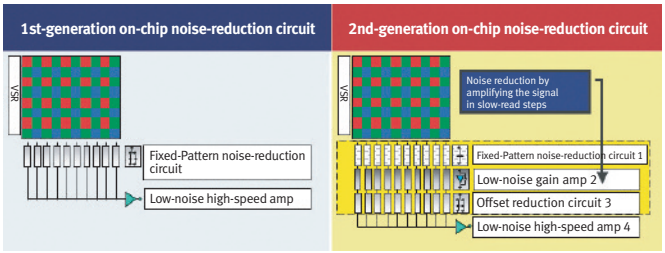


The low-pass filter incorporates two monocrystal plates that separate the subject image into four horizontal and vertical directions. Between these two plates is a phase plate, also monocrystal, which converts the linear polarized light into circular polarized light. The first crystalline plate separates the image into two images



horizontally. The linear polarized light is converted into circular polarized light by the phase plate. The second crystal plate separates the images vertically, resulting in four duplicate images arranged in a square matrix. The image separation in the horizontal and vertical directions is optimized for the sensor pitch so that false colors and moiré caused by minute horizontal and vertical lines in the subject are reduced while resolution is actually increased. Additionally, this hybrid construction, with its deflecting and absorbing layers, reduces image fogging and red ghosting caused by sensor reflections.

The CMOS sensor features a second generation, on-chip, noisereduction circuit that includes a new low-noise gain amp and an offset reduction circuit. The signal is amplified in slow-read steps. The result is the effective elimination of random noise and fixed pattern noise. With the EOS Digital Rebel XT camera, one can even photograph the heavens in the night sky with very low noise.



To minimize the increase in power consumption caused by upgraded components such as the larger sensor and the faster reading of the sensor's output, the output amp's power consumption is kept to an absolute minimum. As with the EOS 20D, power to the output amp is cut off and circuit-driving standard current is also cut off during long exposures. Less power is used and noise is further reduced.

New DIGIC II Image Processor

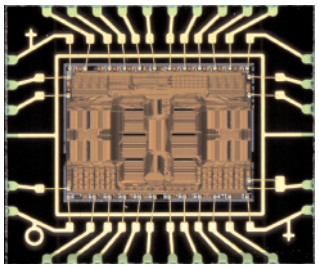
DIGIC II Image Processor

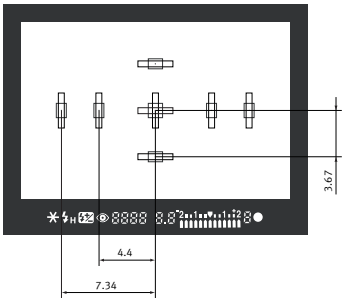
The DIGIC II Image Processor brings a host of significant improvements in speed of operation, control, noise reduction and image quality to the EOS Digital Rebel XT camera. The camera starts up in a near instantaneous 0.2 second. Its shutter release lag time is now only 100 milliseconds and viewfinder blackout time has been reduced to 175 milliseconds. The EOS Digital Rebel XT camera can shoot up to 3 frames per second at its full JPEG Large/Fine 8 megapixel resolution. The DIGIC II's major reduction in buffer clearance times and its huge increase in write speed to the CompactFlash card enable a burst performance of 14 consecutive frames for 8 megapixel JPEG Large/Fine files and 5 consecutive frames for 8 megapixel RAW files.

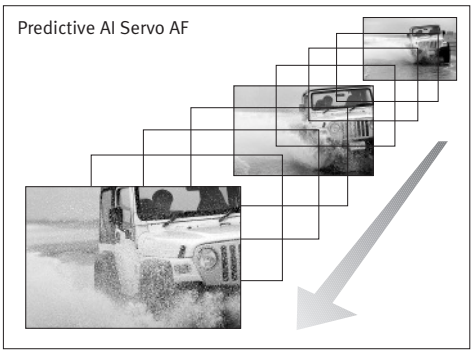
The DIGIC II's newly-developed algorithm also yields improve color reproduction, especially with high-saturation, bright subjects, improved auto white balance precision for a wide range of scenes and light sources, and wider dynamic range in highlight areas.

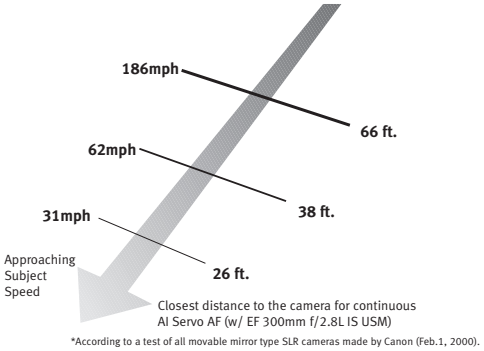
Autofocus

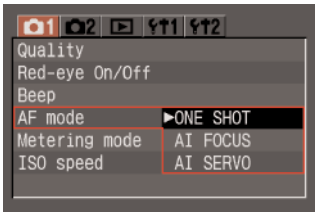
With the addition of the DIGIC II and some fine-tuning, the AF system of the EOS Digital Rebel camera has been adapted to the Rebel XT camera and is fully compatible with the handling speed of the new camera. The EOS Digital Rebel XT camera uses the same 7-point, TTL-CT-SIR (TTL Cross Type secondary image registration) AF sensor as the EOS Digital Rebel camera, as well as the same 32-bit RISC (reduced instruction set) microcomputer. The AF speed and predictive AF performance are faster than or equal to the previous camera. With an EF 300mm f/2.8L IS USM lens, it can focus track a subject approaching at 186 mph up to about 66 feet away. The brightness range required for focusing is EV 0.5 to 18.









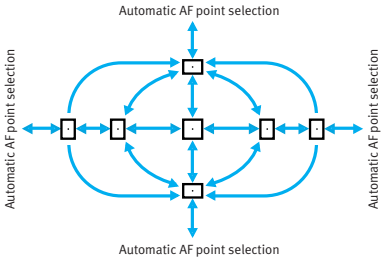


In the Creative Zone modes, the user can now select the AF mode: One-Shot AF (When focus is achieved, the AF operation stops and focus is locked), Predictive AI Servo AF (tracks movement and focuses continuously until the start of the exposure), or AI Focus AF (automatic selection of One-Shot AF or Predictive AI Servo AF based on analysis of subject movement).

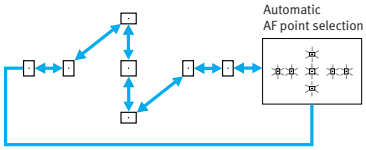
As with the EOS Digital Rebel camera, the EOS Digital Rebel XT camera's predictive AF computation uses statistical prediction that samples the focusing data at a very rapid rate. If focusing operations are repeated in a short period of time, the predictive AF control can operate more effectively from the first shot, even for a subject moving erratically. Additionally, even if the subject's movement changes just before the shutter is released, the predictive AF control will have a good chance of catching it.

The AF point can be selected manually with the cross keys on the back of the camera, or with the electronic dial. The user can avoid pressing the AF point selection button before using the cross keys to select an AF point by activating Custom Function 1-4. The AF point selection operation with the cross keys is similar to the EOS ELAN 7N. With the electronic dial, AF point selection is the same as with the EOS Digital Rebel camera.

[With cross keys]



[With main dial]



To enable manual focusing with the focusing ring, the lens focus mode is switched to M or MF (with Canon EF and EF-S lenses). When focus is achieved, the focus confirmation icon and superimposed display light up.

The AF-assist beam is a series of stroboscopic flashes from the builtin flash or a near-IR patterned LED with a compatible accessory Canon Speedlite. With the built-in flash, the working range of the AF-assist beam is approximately 4 meters/13.2 feet at the center and 3.5 meters/11.5 feet a the other 6 AF points. Firing stops when the focus detection confirmation signal is detected.

E-TTL II Autoflash

The EOS Digital Rebel XT camera incorporates the E-TTL II autoflash system used in the EOS-1D Mark II, EOS-1Ds Mark II and EOS 20D. It is truly remarkable that such a sophisticated algorithm has been included in a camera at the XT's price point. E-TTL II takes effect when the built-in flash or an accessory EX-series Speedlite is used. E-TTL II does not assume that the AF point in use covers the main subject. Instead, when the shutter button is pressed completely, ambient light is measured just before a pre-flash fires. For each metering zone, the ambient reading and the pre-flash reading are compared.

Areas having a large difference between ambient and pre-flash readings are selected and analyzed. Extreme differences suggest a highl reflective or specular object; these areas are eliminated from calculations, avoiding underexposure. When a lens providing distance information is used, this data is also considered in determining

the presence and location of a high-reflectance object. The selected pre-flash readings are added and averaged and the output of the main flash is calculated. Even if the subject changes position, reflectance or size, the flash metering remains highly accurate and stable.

Some other highly useful changes to the flash system of the EOS Digital Rebel camera have occurred:

- User-adjustable flash exposure compensation up to +/- 2 stops in 1/3 or 1/2 stop increments has been added.
- Second-curtain flash synch has been added, via Custom Function 9-1. This function is effective with the built-in flash and also with EX-series Speedlites that lack second-curtain sync control.
- The built-in flash has greater coverage, now handling a 17mm focal length, and the flash head has been raised 5.5mm higher than the Digital Rebel, reducing red-eye and eliminating blockage of flash illumination when using the EF-S 18-55mm and EF-S 17-85mm zoom lenses.
- The built-in flash has a guide number of 13/43 (ISO 100, meters/feet), the highest in its class as of February, 2005.
- The XT supports the new functions of Speedlite 580EX, including auto zoom for picture size and color temperature data transmission.
- Flash exposure bracketing, FEB, is now effective when set with the 580EX, 550EX, MR-14EX or MT-24EX Speedlites.
- Modeling flash is enabled with the 580EX, 550EX, 420EX, MR-14EX and MT-24EX Speedlites. In the Creative Zone modes, press the depth-of-field preview to fire at 70 Hz for 1 second.
- The EOS Digital Rebel XT camera supports wireless flash with the 5 flashes listed above and the ST-E2. Three-group slave control, a flash output ratio control, FEB and modeling flash (with flash output ratio) are all enabled. (The ST-E2 supports up to two slave groups with flash output ratio control, but not FEB or modeling flash.) Note that the 420EX can function as a slave only, while the MR-14EX and the MT-24EX can serve as the master unit only.

White Balance

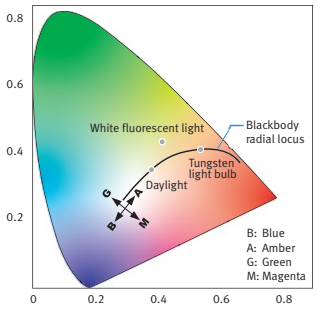
The EOS Digital Rebel XT camera has six preset white balance modes: daylight (approx. 5200 K), shade (approx. 7000 K), cloudy (approx. 6000 K), tungsten (approx. 3200 K), fluorescent (approx. 4000 K) and flash (approx. 6000 K). In addition, it has an auto mode (AWB) and a custom mode.

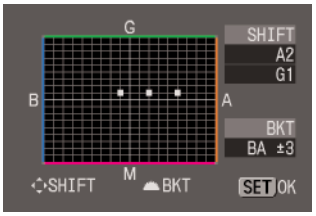
The auto white balance mode has been improved from that of the EOS Digital Rebel camera to make color reproduction more accurate and natural. Moreover, with DIGIC II and an improved algorithm, the white balance is now more stable. Also, color reproduction, especially of natural reds under low color temperature, such as tungsten light, has been improved, as has skin tone reproduction.

For a custom WB setting, first take a picture of a white subject serving as the white balance standard. Then, set the custom WB mode on the onscreen menu and specify that image.

In a substantial upgrade from the EOS Digital Rebel camera, the flash color data transmission function from the EOS 20D enables the built-in flash or an accessory Speedlite 580EX to provide flash color information which is used in exposure calculation when the white balance is set to “AWB” or “Flash.”

The EOS Digital Rebel XT camera shares its white balance correction and bracketing functions with the EOS-1D Mark II, EOS-1Ds Mark II and EOS 20D. Both the blue/amber and the magenta/green biases can be set up to +/- 9 levels. The user can correct or change the color temperature for the white balance mode currently set. One can therefore obtain the same effects usually provided by color temperature conversion filters or color correction filters. Blue/amber and magenta/green corrections can be set in combination. The setting screen is the same as the EOS 20D’s, but the setting operation differs. The cross keys set the desired white balance correction and the electronic dial sets the bracketing.

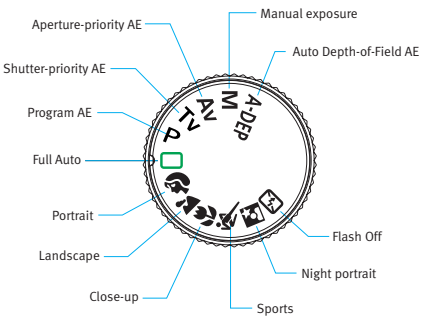




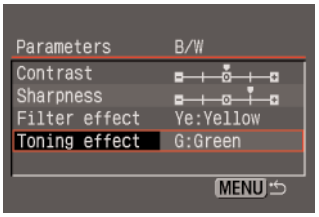
In addition to the blue/amber bracketing offered in the EOS Digital Rebel camera, the EOS Digital Rebel XT camera also provides magenta/green bracketing. Either range, but not both, may be set. When the shutter is released, three images are created, each with a different bias setting in a range of up to +/- 3 levels in 1-level increments. White balance correction and auto exposure bracketing (AEB), can be set in combination with WB-BKT. When AEB and WB-BKT are combined, a total of 9 images will be saved to the CF card. WB-BKT does not work during RAW and RAW + JPEG shooting, since white balance settings can be adjusted during post-processing with the supplied software.

Controls

Along with its new 8-megapixel sensor, one of the biggest differences between the EOS Digital Rebel XT camera and its predecessor, the EOS Digital Rebel camera, is its system of controls and preferences. Of course, the camera can be operated in a fully automatic mode so that it can be use by inexperienced photographers. After brief experience with the exceptional quality of the images the XT camera produces, there is every expectation that the vast majority of XT camera users will explore, and inevitably find indispensable, the many ways in which the camera can be made to do exactly what the user wishes. It is a delight to use such a tool.



Processing Parameters



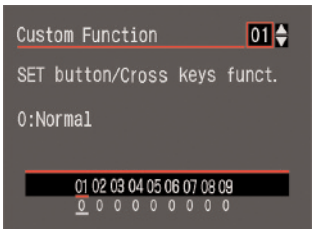
The Digital Rebel XT camera has the same range of image processing parameters as the EOS 20D: Parameter Set 1 (contrast, sharpness and color saturation set to +1) is optimized for vivid, sharp images upon which no retouching will be performed before direct printing. Parameter Set 2 (contrast, sharpness, color saturation and color tone set to 0, i.e., mid-scale), is optimized for images that will be retouched or adjusted. Parameter Sets 3, 4 and 5 can be customized by the user for contrast, sharpness, color saturation and color tone. There is also a monochrome Parameter Set that makes black and white photography easy and great fun. This set incorporates five levels each of contrast and sharpness in addition to filter effects (none, yellow, orange, red and green) that are just like camera filter effects and toning effects (none, sepia, blue, purple, green) that use digital processing to produce prints that look like vintage photochemical artifacts In the Basic Zone modes, Parameter Set 1 is set automatically. In the Creative Zone modes, all six Parameter Sets are available.

Monochrome

Monochrome (R Filter)

Sepia

Custom Functions



The EOS Digital Rebel XT camera adds nine of the EOS 20D's eighteen custom functions to its arsenal of controls.

C. Fn. 1 changes the functions of the SET button and the cross keys and provides for quick and easy access to frequently used functions. The five choices are: 0, Normal; 1, SET button controls image recording quality; 2, SET controls processing parameters; 3, SET controls image playback; 4, cross keys control AF point selection.

C. Fn. 2 enables the dark noise subtraction noise reduction function for long exposures. It provides clearer images of night scenes or the night sky but doubles image processing time between exposures.

C. Fn. 3 sets the flash sync speed in aperture priority auto mode to a fixed 1/200 second or leaves the sync speed on auto/slow sync.

C. Fn. 4 determines selectable functions for the shutter and AE lock buttons. The four choices are: 0, AF/AE lock; 1, AE lock/AF; 2, AF/AF lock, no AE lock and 3, AE/AF, no AE lock.

C. Fn. 5 controls the AF-assist beam. The three choices are ON, OFF and fire only the external flash.
C. Fn. 6 controls whether manually-adjusted exposure level increments are in 1/2 or 1/3 stop units.
C. Fn. 7 enables the mirror lockup function. When C. Fn. 7-1 i selected, the mirror locks up when the shutter button is pressed completely. The shot is taken when the shutter button is released and then pressed completely again. The maximum mirror lockup duration is 30 seconds, after which the mirror returns.
C. Fn. 8 controls whether the E-TTL II autoflash system operates in its evaluative mode or its averaging mode.
Finally, C. Fn. 9 determines whether the built-in flash or an accessory Canon EX-series Speedlite is synchronized to fire after the first shutter curtain completes its travel or just before the second shutter curtain begins to move.

Menus

The Digital Rebel XT camera has ten new menu items compared to the EOS Digital Rebel camera, so a fifth menu column has been added to accommodate this new abundance of choices. Menus one and two are for image recording functions and are color-coded red. In menu one, the user chooses recording quality, red-eye reduction, warning beep, AF mode, metering mode and ISO speed. In the Creative Zone modes, menu two is displayed. It contains auto exposure bracketing, flash exposure compensation, white balance, white balance shift/bracket, custom white balance, color space and parameters.

Menu three is color-coded blue and has 5 playback items: image protect, image rotate, print order, auto play and review time control.

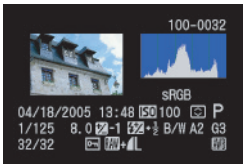
Menus four and five are for camera setup functions. They are colorcoded yellow, with 7 items in each. Setup one has auto power off timecontrol, auto rotate, LCD brightness setting in 5 levels, date/time, file numbering, format and shoot without card. Setup two has a choice of 15 different menu languages, a choice of video systems for playback through a connected TV monitor, data communication preferences (Normal or PTP), custom functions, a clear settings command, a sensor cleaning setting tha locks up the mirror and opens the shutter, and a firmware version readout. For quicker access to key camera settings, the EOS Digital Rebel XT also features a new "Quick Menu" function. When the camera is set for picture taking, the cross keys on the back provide instant access to AF mode, metering mode, white balance settings, and ISO speed. All in all, the menu settings enable Digital Rebel XT users to modify the camera’s performance according to their diverse applications and needs.

Image Display

In playback mode, a timely revision of the Jump function enables the user to move quickly to a particular image or group of images, no matter how far one needs to go. Carried forward is the ability to jump 10 frames. New are both the ability to jump 100 frames and the ability to jump to the first image of another day's shooting. With the jump screen, use the top and bottom cross keys to select the jump method, and then use the left and right keys to jump. Because the Digital Rebel XT camera can take advantage of CompactFlash cards larger than 2 GB, the new Jump function promises to be a real time-saver.

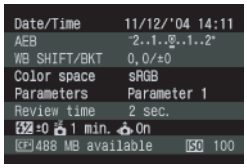
The XT has three different image display formats and controls to determine when or whether such displays should occur. In a sequence shared with the EOS 20D, each time the user presses the Info button during single image playback, the display mode will change as follows: single image with basic information, shooting information (the color space, WB correction and B/W indicator have been added) with reduced image size, and single image without information (another improvement over the EOS Digital Rebel camera). Press the left or right cross key to view the previous or the next image. In the nine image index format, pressing the Info button switches between normal (nine images plus basic information) and nine images without information. In the magnified zoom viewing format, pressing the Info button during image display switches between normal (magnified image with basic information) and magnified image without information.

1. Single Image (with basic information)



2. Shooting Information

3. Single Image (no shooting Information)



Camera Settings

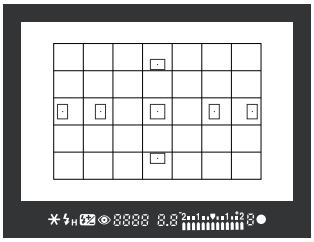
Image review time right after capture is menu settable to off, 2 seconds, 4 seconds, 8 seconds, or Hold. Pressing the Info button during image review switches the Info display on or off. Further choices are Auto play and Auto play right after shooting.

Displayed images can be rotated manually or automatically. Manually, the Playback menu Rotate option enables clockwise rotation of 90º, 270º and 0º. Auto image rotation is settable with the Setup 1 menu's second item. Image rotation is applied during playback and video OUT, not during image review after image capture.

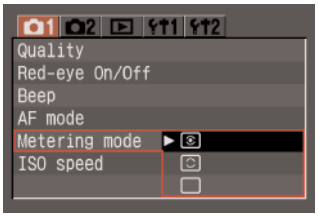
The EOS Digital Rebel XT camera's LCD monitor has received some attention as well. It is the same unit used on the EOS Digital Rebel camera except that a slight difference between the brightness of the image displayed and its actual brightness as viewed on a correctly adjusted personal computer has been resolved by changing the LCD monitor's gamma curve. Setup menu 1, item 3, provides a gray scale to assist in selecting one of five levels of LCD brightness.

Exposure Controls

The EOS Digital Rebel XT camera offers a broad and flexible range of exposure controls. In the Basic Zone modes, evaluative metering, linked to all 7 AF points, is automatically selected. In the Creative Zone modes, partial metering at the center (9% of the viewfinder) and centerweighted average metering are also available. Pressing the left cross key displays the Metering Mode menu.



Viewfinder



Eight exposure modes offer a total of 14 different options: Program AE (shiftable), Shutter-priority AE, Aperture-priority AE, Auto Depth-of-Field AE (A-DEP, non-shiftable), Full Auto (Program AE, non-shiftable), six Programmed Image Control modes (Portrait, Landscape, Close-Up, Sports, Night Portrait, Flash OFF), Manual exposure (including Bulb), and E-TTL II autoflash program (C. Fn. 8-0: Evaluative metering, C. Fn. 8-1: Averaged metering).

The range of available ISOs is from 100 to 1600. In the Basic Zone modes, the ISO cannot be set manually, whereas in the Creative Zone modes, the ISO cannot be set automatically. Pressing the top cross key displays the ISO speed menu.

Manual exposure compensation is enabled in each of the Creative Zones except Manual. Bracketing can extend to +/- 2 stops in 1/2 or 1/3 stop increments. Depending on the shooting mode, either shutter speed, aperture, or both can be varied. Auto exposure bracketing, AEB, is available in the Creative Zone modes and is set with the on-screen menu. The bracketing sequence is, first, the standard exposure, then decreased exposure and, last, increased exposure. The range is the same as with manual bracketing. Conveniently, auto exposure bracketing can be used in combination with white balance bracketing, in which case nine images are generated.

Both auto and manual AE lock are available in Creative Zone AE modes. In the One-Shot AF mode with evaluative metering, AE lock takes effect when focus is achieved. During evaluative metering, AE lock centers on the selected AF point. During partial metering at the center, or with centerweighted averaged metering, AE lock fixes on the center AF point. Normally, manual AE lock is enabled with the AE lock button. Pressing the button again renews the AE lock in the event of subject or camera movement. When the built-in flash or an EX-series Speedlite is used, the AE lock button works as an FE lock button.

Power Management

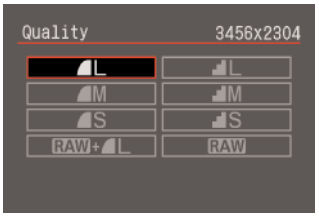
The EOS Digital Rebel XT camera is powered by the NB-2LH lithium-ion rechargeable battery pack. This battery is much smaller and lighter than the BP-511 used in the EOS Digital Rebel camera and is a key to the approximately 25% reduction in volume of the new camera relative to its predecessor. The NB-2LH has only 65% of the capacity of a BP-511 (720 mAh vs. 1100 mAh), but the new camera is 35% more energy efficient, primarily because of the DIGIC II image processor. As a result, the XT can take the same number of shots on a single NB-2LH battery pack as the original EOS Digital Rebel camera with a BP-511. With a fully charged NB-2LH at 20º C/68º F, the XT can take approximately 600 shots without flash, or approximately 400 shots with 50% flash use.

It is possible to double the shooting capacity of the EOS Digital Rebel XT camera by using the new BG-E3 accessory battery grip that can hold one or two NB-2LH battery packs in battery magazine BGM-E3L. If two batteries are loaded, power is initially drawn from the one having the higher voltage. When the voltage level of the two batteries reaches the same level, power is drawn from both packs. When battery magazine BGM-E3A is used, the BG-E3 can hold six size AA batteries. They can be alkaline, lithium or Ni-MH. As with the EOS 20D with the BG-E2, the use of AA batteries should be considered only as a last resort. The NB-2LH is used in several Canon PowerShot S-series cameras, as well as a variety of Canon Mini-DV camcorders, so it is a standard stock item at many Canon dealers.

As with the BP-511A, the battery cover of the NB-2LH has a little hole whose orientation can be used to remind one whether the battery has been recharged or not. That recharging takes about 90 minutes in the supplied CB-2LT battery charger. Available as an accessory, the AC Adapter Kit ACK700 allows the XT to run on external power.

Recording System

The DIGIC II image processor in the EOS Digital Rebel XT camera brings with it several major improvements over the original DIGIC in the EOS Digital Rebel camera. It uses a newly developed algorithm that gives much faster data signal processing while consuming much less power. Color reproduction of high-saturation, bright subjects is improved, as is auto white balance precision, and there is a wider dynamic range in highlight areas.



There are six JPEG quality options, as well as .CR2 RAW only (the new RAW image type featured in Canon digital cameras from the EOS-1D Mark II onward) and a RAW+ JPEG setting in which a RAW file and a Large/Fine JPEG are recorded simultaneously and saved as separate images on the CompactFlash card.

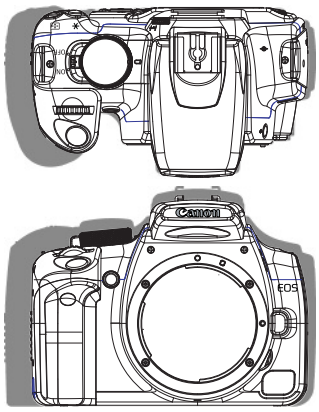
The XT is compatible with Type I and Type II CF cards up to 2 GB or larger capacity. Recording complies with Design rule for Camera File System 2.0 (revised to support Adobe RGB) and Exif 2.21.

The DIGIC II and an improved card-writing process enable the data writing speed of the XT to be approximately 3.5 times faster than the EOS Digital Rebel camera. The DIGIC II, an improved system process sequence during startup, shorter startup processing, and a revamped CF card access method contribute to the XT's startup time of 0.2 seconds, as opposed to the 2.8 second startup time of the EOS Digital Rebel camera.

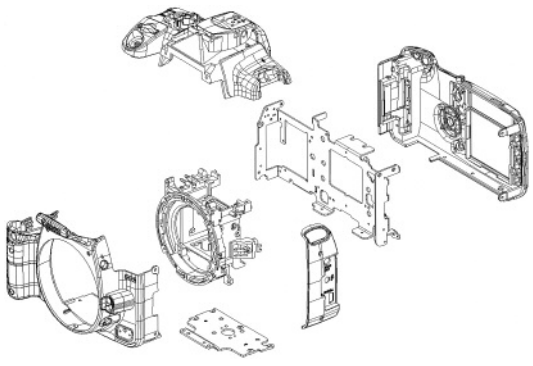
A single image can be protected or unprotected, as set in the Playback menu, item 1. A single image or all images can be deleted from a CF card if they are unprotected. Formatting of the CF card is controlled through the Setup 1 menu, item 6.

Design and Construction

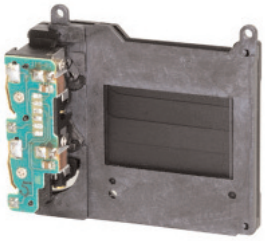
The EOS Digital Rebel camera is not a chunky camera by any means and no one has suggested that it was in need of a diet. By comparison, however, the EOS Digital Rebel XT camera is considerably smaller. From a distance, the XT is stylish and compact; in hand, it is delightful. Compared with its predecessor, the width of the XT is 15.5 mm smaller; the height is reduced by 4.8 mm and the thickness of the body is 8.4 mm less. The weight has been reduced by 2.5 ounces/70 grams The body alone weighs 17.1 ounces/490 grams With a battery, a CF card and the EF-S 18-55mm standard zoom lens, the camera weighs just 1.5 pounds/720 grams.



The body consists of a chassis made of stainless steel, and a mirror box made of high-strength engineering plastic. The mirror box, to which the lens mount and image sensor are attached, is fixed very securely to the chassis to obtain the same body strength as the EOS 20D. This helps prevent the flange focal distance from changing due to the static pressure of the attached lens.

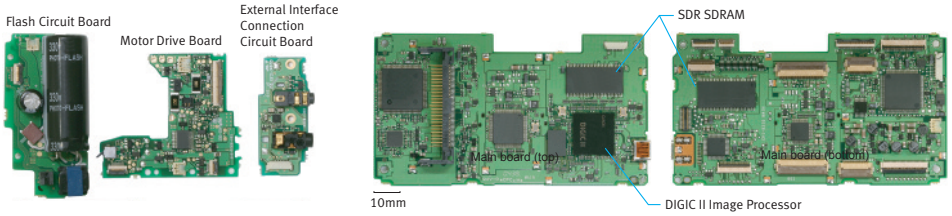


As with the EOS Digital Rebel model, the EOS Digital Rebel XT camera's top, front and rear covers are made of special engineering plastic known for light weight, excellent strength and electromagnetic shielding: ABS resin, polycarbonate resin, and polycarbonate mixed with special conductive fibers. The exterior finish is more refined than the EOS Digital Rebel camera's. The Canon logo is now embossed and colored to give the XT a high-quality appearance. Both titanium silver and satin black body colors will be offered.



As with all Canon DSLRs, regardless of price, value is a major part of the design process. The EOS Digital Rebel XT camera is made smaller, lighter and more affordable thanks to the following:

- The new, compact shutter, designed especially for the XT, is optimized for the APS-C sensor size. In turn, the viewfinder optics, consisting of the mirror box, mirror, focusing screen and so forth,were also downsized and the optical axis was lowered.
- The compact motor was positioned horizontally thanks to an optimized driving mechanism for the mirror, shutter and built-in flash.
- There are fewer large parts because the chassis is fitted with more functions.
- There are fewer connected components because the circuit boards are more highly integrated.
- New components include the DIGIC II, the timing generator, low pass filter and motor driver.
- There is a new, streamlined sensor manufacturing process and a smaller, thinner sensor package.
- The new NB-2LH lithium-ion battery pack is both smaller and lighter than the BP-511.
- Electrical parts in common with the PowerShot family of cameras have been incorporated.
- The shutter release mechanism is the same unit used on the EOS Elan 7E. It provides a shorter time lag (100 milliseconds instead of 120 milliseconds) than the EOS Digital Rebel camera.
- The XT's circuit board configuration consists of five hard boards centering on the digital control circuit board, camera control circuit board, and the DC/DC converter circuit board. Through various connectors, these boards are linked to 14 flexible circuit boards. The EOS Digital Rebel camera had the digital control circuit board and camera control circuit board on one large hard board. To reduce the XT's size further, the main board now includes the DC/DC power supply converter circuit.



Interfaces and Compatibility

Three interface terminals are provided on the side of the body. The EOS Digital Rebel XT camera has a USB 2.0 Hi-Speed, mini-B connector that transfers data from the camera to a computer approximately ten times faster than the USB 1.1 connector on the EOS Digital Rebel camera. Video output is provided for both NTSC and PAL, and provision is made for the RS-60E3 Remote Switch.

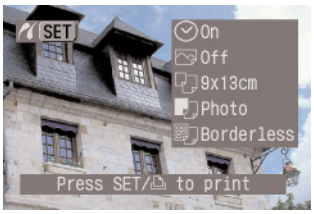
It is possible to operate the XT wirelessly via either the RC-1 or RC-5 Remote Controller. The camera's grip has a built-in wireless remote control receiver. The system is compatible with all shooting modes and has a range of about 5 meters/16.4 feet, front and center. To enable this function, press the Drive Mode button to display the Self-timer/Wireless remote control icon on the top LCD information panel.

RS-60E3

RC-5

The XT complies with Design rule for Camera File System 2.0 and Exif 2.21, updated to support the expanded Adobe RGB color space often used for printed materials. When software compatible with Exif 2.21 is used, images captured with the XT and tagged as Adobe RGB will open automatically in the Adobe RGB color space. Also, when a printer that complies with Exif 2.21 is used, the printer will adjust color saturation for improved results.

Camera Direct Printing



As with the EOS Digital Rebel camera, the EOS Digital Rebel XT camera is currently compatible with PictBridge, CP Direct and Bubble Jet Direct printers. By operating the camera without the involvement of a computer or specialized software, all three of these systems print JPEG images that comply with DCF. DPOF print ordering for direct printing is also possible, as is batch printing of specified images. The basic specifications for these three printing methods are the same as with the EOS 20D. Also shared with the EOS 20D is the XT's compatibility with highspeed printing when the camera is connected to a BubbleJet printer via PictBridge. To promote direct printing, the XT's default Communications menu setting is Print/PTP. PC connection is the alternative.

The EOS Digital Rebel XT camera also has the same Direct Print or Easy Printing feature found in the latest PowerShot cameras. (Unlike the PowerShot cameras, the XT does not have a feature to transfer images directly to a personal computer.) When the XT is connected to

a printer compatible with direct printing, select playback and choose the image to be printed; confirm the print setting and press the Direct Print button while its blue LED is lit.

Software The software bundled with EOS Digital cameras in 2004 was composed of products centered on the EOS Viewer Utility. With the EOS Digital Rebel XT camera, the role of EVU will be taken over by a new software configuration centered on the ZoomBrowser EX / ImageBrowser applications supplied with the camera. Canon will also supply Digital Photo Professional software with the XT for professional and high-end amateur photographers who prefer to use RAW images.

The EOS Digital Rebel XT camera will be supplied with three CDs, all Windows/Mac hybrids, the EOS Digital Solution Disk, v. 10, the Digital Photo Professional v. 1.6 CD and the Software Instruction Manual CD.

The following can be found on the EOS Digital Solution Disk:

ZoomBrowser EX v. 5.1 (Windows)/ImageBrowser v. 5.1 (Mac) is the main viewing/editing software for the XT. Its task button and wizard-type interface is aimed primarily at a range of users from novices who shoot mostly JPEGs to advanced amateurs. It facilitates functions such as image downloading, specifying camera settings, remote shooting, image printing, multiple image viewing modes, RAW image processing for virtually all EOS Digital cameras, and image merging by starting or linking to the respective applications from ZoomBrowser EX/ImageBrowser.

CameraWindow, v. 5.1 (Windows/Mac), controls communication between the camera and the computer. At default settings established when the software is installed, the Camera Window is automatically displayed when the camera is connected to the computer and allows the user to transfer images saved on a memory card in the camera to ZoomBrowser EX or ImageBrowser and to specify settings on the camera.

PhotoRecord v. 2.2 (Windows) also uses a task button and wizard-type interface. It links to ZoomBrowser EX to provide advanced yet easy-to-use image layout, image size adjustment, frame selection, text caption entry and other printing functions.

RAW Image Task v. 2.0 (Windows/Mac) works within ZoomBrowser EX and ImageBrowser. It allows users to display and process RAW images and to restore the processing parameters used on the camera. Its algorithms are well matched to Canon cameras, providing image processing with the same color tones as the camera itself. It also features functions for converting and saving RAW images as TIFF or JPEG and for adding ICC profiles. It is compatible with color management systems.

EOS Capture v. 1.3 (Windows/Mac) is a remote shooting software application. It allows the camera to be controlled and camera settings to be specified from the computer and saves shot images to the computer. It also allows the user to take shots by pressing the shutter button. It is identical to version 1.2 apart from the addition of the EOS Digital Rebel XT camera to the list of supported cameras.

PhotoStitch v. 3.1 (Windows/Mac) uses a simple procedure to merge multiple JPEG images to create composite images such as panorama shots.

ArcSoft PhotoStudio v. 5.5 (Windows/Mac) is also supplied on EOS Digital Solution Disk v. 10. It provides powerful image editing capabilities with a sophisticated yet easy-to-use interface.

Also included are WIA drivers for Windows XP and Me and TWAIN drivers for Windows 2000 and 98SE.

Digital Photo Professional v. 1.6 (Windows/Mac) is supplied on a separate CD. DPP 1.6 is a powerful RAW workflow and image editing application program aimed primarily at professional and high-end amateur photographers who shoot RAW images. It uses Canon's own algorithms to provide fast RAW image display and processing and offers a range of real time image adjustment functions.

IV. CONCLUSION

When the original EOS Digital Rebel camera was introduced, it was the first interchangeable-lens digital SLR to break the $1,000 price barrier. The approximate retail price was $899* for the body and $999* for the kit with the EF-S 18-55 mm lens. It had 6.3 megapixels, superb, low-noise images, long battery life, and it looked cool. There was nothing even remotely like it. No wonder Canon sold them by the ton and defined the under-$1,000 DSLR category in the process. The EOS Digital Rebel camera will remain in the Canon lineup at a reduced price. It will, undoubtedly, win new converts and create a whole new category once again. (* Actual selling prices are set by dealers and may vary.)

Now the EOS Digital Rebel XT camera arrives. It is smaller and lighter, svelte, actually. It has even higher resolution and image quality, and a complete set of user controls. Combined with its extra-fast startup time, quick shutter release, short finder blackout time and excellent burst performance, Canon is defining the under-$1,000 DSLR category once again.

Canon has discovered the power of a unique selling proposition: Make products that exceed the performance and value of everything else in their categories. That was the case with the original EOS Digital Rebel camera. It was certainly the case with the EOS-1D Mark II, EOS-1Ds Mark II and EOS 20D cameras. It will surely be the case once again with the EOS Digital Rebel XT camera.

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